ICE

2ND ISSUE 1971 NUMBER 36

GLACIOLOGICAL SOCIETY

1972 ANNUAL CONFERENCE

This will be held in Cambridge, England, on 20 and 21 April. The Annual General Meeting will take place during the Conference. There will be a Dinner on the evening of 20 April and an informal party on the evening of 21 April. An important event this year will be the presentation of Seligman Crystals to two people who have made great contributions to glaciology.

For details, see pages 14 and 17 of this issue of ICE.

THIS IS **YOUR** CONFERENCE — each year more and more people attend — COME AND TAKE PART, in April 1972

ICE

NEWS BULLETIN OF THE GLACIOLOGICAL SOCIETY

2ND ISSUE 1971 NUMBER 36

CONTENTS

1972 DUES. As announced in circulars sent to members and to libraries in July 1971, there will be an increase in dues as from 1 January 1972. The Treasurer's Report at the Annual General Meeting (p. 15 of this issue of ICE) explains the need for increasing our income: the first time since 1965, and only the second time since 1958.

Bankers' Standing orders: Members who pay by this method have been asked to alter their orders in time for the new financial year (1 January), and many members have already done so. We regret that we shall not be able to send the 1972 publications to members who have not altered their orders before the first of the 1972 Journals is ready for mailing (February). After the last increase in dues, we found that several members who paid by Bankers' orders took 3, 4 or even 5 years to make the necessary alteration; this resulted in the expenditure of much secretarial time and postage.

SELIGMAN CRYSTALS. For news about the latest awards, see the section in this issue of ICE on the activities of the Glaciological Society.

COVER PICTURE. Ice-bound water: Gulfoss, Iceland, in winter. Photograph by Hjalmar R. Barðarson, Reykjavík, Iceland.

FIELD WORK

AUSTRALIA

ANTARCTICA

During six traverses over the **Wilkes** local ice cap Les Denham, with help from different members of the 1970/71 ANARE team at Casey, measured ice thickness (by radar), surface elevation, gravity, and accumulation, to complete an earlier geophysical survey of the Bureau of Mineral Resources on a 16 km mesh square grid over the entire ice cap. A great deal of new ground was covered on its eastern side in the region of the Totten glacier where the existing maps were found to deviate substantially from reality. During one of the traverses Dave Bromwich carried out 25 atmospheric soundings with kytoons and Jalbert (AKA Special) kites, obtaining temperatures and some winds up to heights of the order of 300 m above the surface in light to moderate katabatic wind conditions.

The series of strain grids established by Dr D. Parker in 1969 on the ice cap east of the **Vestfold Hills** was remeasured and extended by John Stalker, Dick Westward, John Taaffi, and Dr Geoff Boyd, of the 1970 ANARE expedition to Davis, in a motor toboggan traverse to a point near the 2000 m contour at 69°31'S 80°40'E. The restricted logistics made it necessary to establish three depots and to travel almost 1000 km to set up the 13 strain grids and 78 barometric levelling stations on the 200 km route. Its end is to provide one of the starting points for a glaciological survey along the 2000 m contour around the entire Lambert glacier basin.

A six weeks visit in February and March 1971 to **Heard Island** by upper atmosphere physicists of the Comité National Français de Recherches Antarctiques (CNFRA) in the ship "Gallieni" provided opportunities for members of the Antarctic Division to continue the surveillance of the island's glaciers, initiated and pursued with unflagging zest over the years by Grahame Budd. As a new long-term programme detailed observations were initiated of surface topography, ice movement, gravity, and accumulation on the Vahsel glacier not far from Atlas Cove.

AUSTRALIA

Gorow Wakahama, of the Institute of Low Temperature Science in the University of Hokkaido, during a four months stay as Leverhulme Visiting Fellow at the University of Melbourne (extended to six months by a grant from the Antarctic Division, Department of Supply) took time off his laboratory work on the ANARE ice cores from the Amery ice shelf and the Wilkes ice cap to study snow characteristics in the Australian Alps. He was searching for additional clues to help him improve the racing quality of the snow for the 1972 Winter Olympics in Hokkaido.

Preparations have begun at the University of Melbourne for an expedition at the end of 1971 to the Carstensz glaciers of West Irian, first explored by J. J. Dozy (cf. Z.Gletscherkunde **26,** 1938, 45-51). This is to be led by Randell Champion, the glaciologist of the 1968 ANARE expedition to Wilkes (Casey), and include workers from four Australian universities as well as two Indonesian scientists.

U. Radok

JAPAN

ANTARCTICA

A party of eleven men led by Dr Shimizu made a severe winter journey over Enderby Land in four snow vehicles. During the journey a small hut made of corrugated iron was built at 70° 42.6'S, 44° 18.9'E (2167 m above sea level) and named "Mizuho Camp". A three-month automatic recorder was installed in this hut to measure various meteorological elements. Around the Camp, some glaciological studies on subsurface snow (accumulation, stratification, density, grain size, hardness) were carried out in a pit four meters deep and in 20 m bore holes. The mean annual temperature was estimated as −33.5°C from the temperature profile data. Seismological sounding and gravity deviation measurements were also made. The Camp will be used as a station for the proposed 400 m deep boring in 1971-73.

Eight men, led by Dr Shimizu, left Syowa Station on 3 November 1970 and returned on 21 January 1971, covering approximately 1650 km over Mizuho and Sandercock Nunatak areas. The trip was part of the Enderby Land Mass Balance Research Project, which was begun in 1968. Surface topography of the ice sheet was measured by barometric altimeter and the thickness of the ice sheet by radio-echo sounding, seismic and gravitational methods. Fifty-five snow stakes were set covering 200 km between Sandercock Nunataks and "Mizuho Camp". Four square strain grids with sides 1 km in length were also set. The resurvey of the stakes and grids will be made in 1974-75.

OTHER EXPEDITIONS

H. Tanaka, Geology Department at Hokkaido University, stayed on Gyajo Glacier near Namch-Bazar, East Nepal, with one sherpa from May 1970 to January 1971. He measured flow velocity, strain rate, accumulation and ablation, using 50 stakes set on the glacier. An ice fabric study was also made. So-called "Stockwerk Tektonik" in structural geology was seen on the surface of the terminal cliff of the glacier.

From 21 April to 10 June 1970 a research group from the Institute of Low Temperature Science and led by Dr T. Tabata took part in an expedition to Arctic regions. The party visited Point Barrow, Alaska, and Tuktoyaktuk, Resolute Bay, Greely Fiord and Tanquary Fiord in the Canadian Arctic. At Tuktoyaktuk the party measured stress and strain in fast sea ice using waterproof strain gauges, electrical load cells and pressure gauges buried within the ice.

JAPAN

A study of hard snow in mountainous regions

The physical properties of hard snow found in mountainous regions have been studied by the Institute of Low Temperature Science with special reference to the preparation of the ski courses for the Winter Olympic Games in Sapporo. Ski competitors suggested that a natural hard snow found in high mountains might provide the best ski-run for the slalom events. Observations were made at Mt. Daisetsu (Hokkaido) and Mt. Zao and Happo-One (Honshu) to investigate physical properties and microscopic textures of hard snow formed naturally in these mountains. Two types of hard snow, wind packed snow and hard depth hoar, showing different microscopic textures, were found at summits or ridges of these mountains. The average density and hardness of these hard snows were 0.5 g/cm^3 and 10 kg/cm^2, respectively. The values have been tentatively accepted as the necessary minimum values which the Olympic slalom ski-run should satisfy.

Preparation of ski-runs for the Winter Olympic Games

The Sapporo Olympic Organizing Committee prepared three slalom courses on Mt. Teine (1030 m high) and one down-hill course on Mt. Eniwa (1300 m high). About 700 men were enlisted from the Japanese Defence Forces to make these courses. Some serious problems occurred but were solved: in the down-hill course on Mt. Eniwa, large snow caves were created underneath the hardened snow because of elevated soil temperature due to volcanic action. Thick thermal insulators covering the soil surface solved the problem. At several steep slopes on the slalom courses on Mt. Teine, very little snow was deposited because of strong winds. Previously compressed snow blocks were transported there from lower areas to cover the bared surfaces and were frozen on to them by water sprays. Compaction of snow on gentle slopes was made by snow vehicles but snow lying on steep slopes had to be hardened by trampling. Immediately after the finish of the International Winter Sports (pre-Olympic Games) held successfully in February 1971, the hardness of compressed snow was measured along the ski courses. The measured values were rather scattered, with an average of 7 kg/cm^2.

Perennial snow

Dr K. Higuchi and his colleagues have been conducting a mass balance study of the perennial snow patch called "Hamaguri-Yuki" in Teteyama, Honshu, Japan. The mass balance of the snow patch was positive (accumulation) in 1968, negative (ablation) in 1969, and positive at the upper part and negative at the lower part in 1970. Drs Higuchi and Iozawa completed the "Atlas of Perennial Snow Patches in Central Japan" (81 pp) in accordance with the recommendation of the Commission of Snow and Ice, IASH. The Atlas contains many maps, air photographs and tables, showing locations, sizes, altitudes, lengths, mean widths and areas of 435 perennial snow patches surviving in 1968-1970. Copies of the atlas may be available for distribution (write to Dr Higuchi).

Snow removal

Seven years ago, the Japanese National Railways constructed a super express railroad (the New Tokaido Line) between Tokyo and Osaka. When the super express train travels on snow covered railroad tracks with a high velocity of 200 km/h, many snow particles were lifted up by the turbulence caused by the train itself and these adhered underneath the coaches, giving rise to many troubles. This serious problem was solved by means of several sprinklers distributed along the tracks and using warm ground water to melt snow on the tracks. This method will not be effective, however, when the super express railroad is extended to cold snowy areas, and therefore experiments are being made by the Technical Research Institute of the Japanese National Railways to find other methods for snow removal.

Drifting snow

Since the late Dr Oura began to study drifting snow, many field observations have been carried out by the staff of the Institute of Low Temperature Science. Recently, the rate of drifting snow and the effective drifting distance were measured with the aid of long pits normal to the wind direction excavated in snow with various spacing. Saltation of snow particles was studied cinematographically in relation to the initiation of blizzards in a turbulent atmosphere. Studies of atmospheric turbulence under extremely stable conditions are planned at Syowa Station and Mizuho Camp in Antarctica.

Laboratory work

Many core samples of surface snow (10 m in depth) were obtained by the Eleventh Japanese Antarctic Expedition Party every 100 km along the route from Syowa to the South Pole. The vertical distributions of density, hardness and microscopic textures of these cores have been analyzed in the cold room of the Institute of Low Temperature Science. Dr Murozumi, Technical College of Muroran, analyzed Na, K, Ca and Mg ions in these core samples using both atomic adsorption and ionized mass spectroscope methods.

Dr Wakahama joined Dr Radok's laboratory at the University of Melbourne, Australia, as a Leverhulme Visiting Fellow from 25 July 1970 to 28 January 1971 and analyzed deep core samples from Amery Ice Shelf, Wilks Dome Summit and Cape Folgar. He also studied recrystallization processes of deep core ice, using a compression apparatus designed by him. He bought about 40 deep ice cores to Japan to make more detailed analysis.

The Institute of Snow and Ice Studies, Nagaoka, Niigata Prefecture, has been engaged in studies of the prevention of disasters caused by snow. The Institute has a test slope for observing snow slides. The interface between the sliding snow and the slope can be observed through the transparent window of an underground laboratory. Creep tests of wet snow, which is usual in this prefecture, are being carried out on this slope. Many new instrumentations and techniques for observing snow, such as a thickness meter using audio- and ultra-sonic waves and a intensity meter for snowfall using scattering of infrared rays, have been developed in this Institute.

Studies on the fundamental properties of snow and ice, such as dielectric properties, dislocations, recrystallization and crystal growth, are being carried out in the Physics Section of the Institute of Low Temperature Science and in Dr Higashi's laboratory at the Faculty of Technology, Hokkaido University. B. Salm (Federal Institute for Snow and Avalanche Study, Davos, Switzerland) joined the Institute of Low Temperature Science as a visiting scientist from 25 December 1969 to October 1970. He did much valuable work on the deformation of snow, using an automatically controlled compression machine in the cold room.

Daisuke Kuroiwa

NEW ZEALAND

GLACIOLOGY SECTION, WATER AND SOIL DIVISION MINISTRY OF WORKS

Seasonal snow

Snow surveys have continued at two courses in the foothills of the Southern Alps. Records over the past six years show great variability in depth and duration of snowpack from year to year.

Tasman Glacier

Accumulation and ablation have been measured at six sites on the upper glacier. Markers were buried at the peak of the accumulation season, resulting in an incomplete record. The equilibrium line on the main glacier reached an altitude of about 2000 m after an exceptionally dry summer, although ablation in late summer was considerably reduced by light snowfalls. At the end of the summer, cores were taken to 12 m depth at the highest site (2340 m). Stratigraphic levels, marked artificially at the site, were identified down to the 1968 summer surface at 11 m.

Ivory Glacier

Net mass balance for 1969-70 was a loss of 3 m water equivalent, over a surface area of 1.15 km^2.

During 1970-71 the glacier again showed a strongly negative net balance. Records of accumulation are incomplete because avalanches in the spring obliterated the upper part of the stake network. At the end of the summer, bare ice was exposed almost to the head of the glacier, except for a residual accumulation of avalanche snow at the centre of the glacier. Aerial photographs were taken at this time, and a geodimeter survey of ground control points was completed. A map of the glacier can now be prepared.

A Kasser hotpoint drill was used to install ablation poles this year. Continuous records of incoming solar radiation and air temperature were obtained at a site on the glacier over a period of four months during the summer. The water level recorder previously installed was damaged by ice rafted downstream, and has been replaced by a pressure-bulb recorder.

Regional

Aerial photographs of all major glaciers in the Mount Cook region were taken during April and will be compared with earlier photographs which were taken in 1965 for topographic mapping.

P. W. Anderton
T. J. Chinn

ANTARCTIC RESEARCH PROGRAMME

Work, begun the previous season, was continued on the "alpine" glaciers of the Asgard Range, Wright Valley, South Victoria Land. Mass balance studies were continued on the "Jeremy Sykes Glacier" and initiated on the nearby "Heimdall Glacier".

Margin studies were made on both of these glaciers to establish a possible relationship between margin morphology and glacier balance.

Intersecting photographs from marked and measured baselines were taken of the snouts of the two "alpine" glaciers and of the Wright Upper Glacier. Over a long period, continuation of this programme will enable a comparison of margin variations to be made between the different selected glaciers.

Water level recording was continued on Lake Vanda and the Onyx river. This season was one of exceptionally high flow in the river. Lake Vanda water levels rose 2.36 m over the summer (some 15 times the normal rise). The Onyx river reached a peak discharge of approximately 8.5 m^3 per sec. (300 cusecs), some 8 times the peak discharge of the previous season. Various flow measurements indicated that the source of the river was at the coastal Piedmont Glaciers, and that the valley side glaciers contribute less than 10% of the meltwater.

T. J. H. Chinn

NORWAY

SPITSBERGEN

In 1970 mass balance studies were carried out on the two glaciers Brøggerbreen and Lovènbreen on Spitsbergen. The glaciers are situated a few km from the Norwegian geophysical station in Ny-Ålesund. As in the four preceding years the mass balance in 1969-70 was negative. Almost no snow was left in the accumulation area and blue ice was seen right to the top of the glaciers.

In Spitsbergen, 12 glaciers are surging at the moment. The largest surges are made by the glaciers Hinlopenbreen and Tunabreen. Hinlopenbreen, which is 60 km long and 8 km wide at the front, had a mean velocity of ca 12 meters a day in the period August 1969 to August 1970. Two outlet glaciers from Hellefonna near Agardhbukta on the east coast of Spitsbergen are also making violent advances. The southern one is now advancing over ground probably not covered by ice since the last ice age. The northern one is crossing the Fulmer Valley. A hut in the middle of the valley is broken and overrun by the glacier and a 5 km long lake is dammed on the east side.

A short visit was made to Spitsbergen in April 1971. A flight was made to the Tuna- and Hellefonna glaciers. The first was still advancing with a velocity of ca 1 m a day, breaking and disturbing the fjord ice, far ahead of the glacier front. On the same visit drilling was carried out on a glacier overlying one of the coal mines in Adventdalen. Temperature was measured in the holes and in the mines to investigate the permafrost conditions under the glacier.

ANTARCTICA

The Norwegian glaciological programme in Antarctica started in December, when 6 men were carried from McMurdo by an American aircraft to 1°W—72°S in Dronning Maud Land. A velocity and gravity profile of the large 50 km wide Jutulstraumen ice stream was measured. A rough estimate of the mass transport through the profile can now be made.

NORWAY

Mass balance studies were carried out on 11 glaciers: nine by the Norwegian Water Resources and Electricity Board and two by Norsk Polarinstitutt. As in the previous year the balance was negative on all glaciers.

Length fluctuations were also registered on ten glacier tongues. All were retreating except the Engabreen glacier in north Norway which advanced 34 meters.

Olav Liestøl

POLAND

POLAND

In 1970 the systematic snow cover investigations in the Polish mountains, especially in the Karkonosze Mountains in the region of Szrenica (Mountain Branch Observatory of the Meteorological and Climatological Department of Wrocław University), were carried out under the leadership of Dr A. Kosiba.

These investigations concerned: (a) all parameters necessary to estimate the conditions and processes of snow cover formation, duration and ablation, according to radiation and meteorological factors on the one hand and topographical-hypsometrical, soil and forest environment on the other hand; (b) the role of snow cover in the formation of water resources.

The investigations took into account the relative area of the snow cover according to a scale 1-10 introduced by Kosiba, its thickness, density, structure and texture and the thermal profile from surface to ground. These observations were made systematically several times a day on Szrenica, and from time to time during the winter along many profiles in other places.

For the radiation and meteorological studies measurements were made of the intensity of direct radiation (pyrheliometer) of hemispheric radiation (solarigraph and diffusograph), of sunshine duration (heliograph), atmospheric pressure (barograph), temperature (thermograph), humidity (hygrograph and psychrometers), wind velocity and direction (anemograph), precipitation (normal

and mountain pluviographs), evaporation and cloudiness.

In connexion with the topographical-hypsometrical and forest environment, snow measurements were made at the stakes installed along different longitudinal and transverse profiles: slopes, valleys, rocks, grass and different types of forests (for example, old, young, dense, coniferous, mixed).

Processes of snow drifting and sedimentation by rime frost were also studied. The latter is a very important component of water resources in Karkonosze, but very destructive for forests. Different methods were used to compare and evaluate the influence of rime.

In the Karkonosze Mountains there are very frequent and dynamic föhn winds, especially during winter, and they are very destructive of water resources. They cause frequent and intensive ablation and intensive evaporation of the snow cover during winter. The föhns are also very bad for the forests for they reduce the snow cover and so the water supply. So the föhn processes, as well as snow ablation and evaporation, are taken into consideration. In the past few years there were many great forest disasters in the Karkonosze and Tatra Mountains.

The snow investigations are also carried out at the summit station Sniezka in the Karkonosze and in the Tatra mountains.

SPITSBERGEN

In 1971 the glaciological-climatological investigations on the Werenskiold and Hans Glacier in SW-Spitsbergen were carried out by a Polish expedition of 8 members, mainly assistants from Wrocław University. It was the continuation of glacio-meteorological investigations carried out in the framework of IGY/IGC in 1957-1960 by a glaciological group under the leadership of A. Kosiba.

The leader of the glaciological group in 1970 was Dr S. Baranowski, assistant in the 1957-1960 expeditions. He is also the leader of the 1971 summer expedition to W. Spitsbergen, for continuation of the glaciological-climatological investigations. The 6 members of this expedition are also mostly assistants from Wrocław University.

In the laboratory, the results of the glaciological-climatological investigations in Spitsbergen 1957-1960, 1962, 1970 and in Greenland 1963 and 1964 are in the final phase of elaboration.

A. Kosiba

U.S.S.R.

In 1970 Soviet glaciological expeditions carried out investigations on the glaciers of the Caucasus, Central Asia (Soviet part), Altay, Kamchatka, Polar Urals and Antarctica.

CAUCASUS

(1) The Caucasian Expedition of the Glaciological Department of the Institute of Geography, USSR Academy of Sciences, continued the IHD programme of investigations in the representative mountain glacier basins in the river Marukh (Western Caucasus) and Chkhery (Eastern Caucasus). The main investigations carried out in this region were accumulation and ablation, survey, snow-cover compaction, snow-storm transport observations, survey of dust distribution along the glacier surface in order to determine the main direction of the snow-storm transport. Observations of ice formation processes were continued in a deep pit where stratigraphy, and compaction and density of firn were measured, and for the first time lysimetric observations were made (by means of pumping) of the intensity of vertical water flow at different depths in the firn and of horizontal water flow above the ice waterproof horizon. Observations of water variations in the bore hole were carried out. It was established that all interglacial water streams were connected into a single system which was common both for ablation and accumulation. This became clear from the abrupt simultaneous drainage of the system in the middle of the ablation season. In the accumulation area meteorological observations were undertaken.

On the Besengy glacier longitudinal and transverse profiles were made with radio echo sounding equipment. Sediment run-off from the glacier basins Murukh, Djankuat (basin of the river Baksan) and Gergety (basin of the river Chkery) was measured. A more complete picture of the run-off formation processes in the alpine zone was obtained.

Observations were made of the front part of the Kolka glacier, which surged suddenly at the end of 1969. In March-April, July and September phototheodolite resurveys of the advanced part of the glacier were carried out and maps made on a scale of 1:5 000. Cumulative graphs of maximum possible and actual water accumulation in the basin of this glacier were made from hydrological and glaciometeorological calculations, and possible volumes of floods and mudflows (after temporary retention of the water in the basin) were determined.

On the basis of observations on the glaciers Marukh and Kolka, the heat balance of melting and its relation to different types of weather were analysed. The relation between turbulent heat exchange and wind speed was also established.

(2) The major investigations of the Problem Laboratory of Snow Avalanches and Mudflows, Geographical Faculty, Moscow University, were carried out in the IHD representative basin Djankuat (May-September). The following work was carried out: 1) two snow surveys on the glaciers Djankuat and Koi-Avganaush and on the non-glacial part of the basin; 2) survey of the snow remaining at the end of the ablation season; 3) determination of values of snow, ice and firn ablation (during ablation season) by means of snow resurveys, pits and 100 stake measurements; 4) every 5 days during the ablation season, plotting on a map of the position of the temporary snow line; 5) mass balance determination for the 1969-70 balance year which was slightly positive; 6) hydrometric observations at two control points (June-September); 7) observations of air temperature, humidity and precipitation at 4 points in the basin; 8) radiosounding of the glacier accompanied by thermodrilling at several points (in the lower part of the firn basin one of the bore holes reached 75 cm); 9) tentative determination of firn thickness by seismosoundings; 10) study of ancient and modern moraines on the glaciers Djankuat and Bashkara, and of subterrain water in these moraines by means of electro-soundings; 11) phototheodolite resurvey of the glacier snout and determination of ice velocity at some points. These data were used to develop methods of calculation of ablation, river discharges with glacier nourishment, glacier floods and mudflows, and to investigate the processes that determine mass-energy exchange.

(3) The Geographical Institute of Georgia undertook investigations of glaciers on the southern slope of the Central Caucasus. A phototheodolite survey (on the scale of 1:5 000) of glacier snouts of 4 glaciers was made. Surface movement velocities, vectors, values of ablation and deformation, and positions of snouts were determined by geodetic and pseudoparallactic methods. Glaciological, hydrological and meteorological observations were carried out to study the regime of ablation and glacier run-off on the Tbilisi glacier. Observations of melting were carried out from stakes in the range 2800-3500 m. Formation of surface run-off was studied by means of run-off grounds at 3000 and 3500 m and river control sections were set up to study glacier regime.

(4) Kharkov University took over the study of present-day and ancient glaciation of the Caucasus. On the Tsei glacier the following work was undertaken: actinometric and gradient heat balance observations at two points, albedo survey of the glacier tongue, and movement and melting of ice (by stakes and on a run-off ground) in environments of different exposure, steepness, moraine cover and altitude. Heat balance calculations for the glaciers of Ptish (the Tiberda basin) and Bashkara (the Baksan basin) were made, and a relation between the increase of rings on the trees and meteorological elements was established which would help reconstruct meteorological conditions of the years when there were no instrumental observations.

(5) The Georgian Hydrometeorological Institute took over observations of variations of 12 glaciers. At stationary profiles the following items were measured: velocity of movement, total ablation and level of glacier surface. A theodolite survey of glacier snouts was made. On the Gergety glacier observations were continued according to the IHD programme. The main characteristic of 1970 was a cold summer —the main monthly temperature during the ablation season (June-September) was 0.3-0.9° lower than the normal one. The observations showed that the thickness of the Caucasian glaciers from the end of 1969 till the end of 1970 ablation period increased on the average by about 1 m. Velocities of glacier movement were 20-25% above normal. Only 3 out of 12 glaciers studied retreated slightly, the rest, the glaciers of the Kasbegy massif in particular, advanced 3-5 m. An exception was the Kolka glacier which advanced from September 1969 to January 1970 about 4.5 km. The present growth of glaciers from 1959-60 is continuing.

(6) The Rostov-on-Don Hydrometeorological Observatory conducted investigations on the Murukh glacier: meteorology, heat balance and hydrology, observations of precipitation at a network of precipitation gauges, snow accumulation, melting of snow and ice, ice movement, glacier retreat. The Observatory also undertook a traverse of the glacier basin Mzimta, observations of variations of 11 glacier snouts in the river basins Terek and Kuban, and observations of precipitation at a network of precipitation gauges at altitudes 1500-3500 m asl in these two basins. The data showed that during the cold season of 1969-70 some glaciers advanced; some of them had been advancing for some years. The cause of this is favourable weather conditions: records of the station Ordjonikidze showed that during the ablation period 1969-70 air temperature was about the mean for many years and the sum of precipitation was 15% higher.

CENTRAL ASIA (SOVIET PART)

(1) Glaciological investigations by the Sector of Geography, Academy of Sciences, Kazakh SSR, included observations according to the IHD programme in the representative glacier mountain basin of the river Malaya Almatinka, and also observations of glacier variations and a study of the physical properties of snow, ice and frozen soils. The main regions of field work were Zailiiskiy, Djungarskiy and Kungey Alatau.

The investigations included measurements of atmospheric precipitation in the area of the glaciers, accumulation and ablation on the glaciers, velocities of movement and deformation of ice, measurements of glacier surface level (levelling by fixed profiles) and their snouts, ice temperature and temperature of firn and snow (thermosounding), and glacier run-off.

The main characteristic feature of the 1970 summer was stable anticyclonic warm weather, not observed in this area for the last decade. The boundary of seasonal snow reached higher altitudes than in 1969 but was lower than in 1968. Ice ablation was 20-30% more than in the previous year. The snouts of some glaciers retreated, others advanced or remained stationary. On the basis of the preliminary estimation, total mass balance was negative.

(2) The Glaciological Laboratory of the Institute of Geology and Geophysics, Academy of Sciences, Uzbek SSR, carried out field investigations on the glaciers in the river basin Pskem. Hydrological, meteorological, actinometric and gradient observations, snow surveys, observations of melting and changes of form and size of glaciers were made. More attention was paid to the characteristics of the moraine cover and its influence on the glacier regime and to a study of the role of glacier crevasses in the process of melting and run-off.

(3) The Glaciological Expedition of the Central Asian Hydrometeorological Institute took over the investigations (according to the IHD programme) on the Abramov glacier, situated on the southern slope of the Alay range. The field work included glaciological, meteorological, actinometric, gradient, hydrological and heat balance observations. The accumulation was measured by traverse snow surveys on the whole glacier surface, ablation only on the glacier tongue. The role of firn in the formation of river run-off in the glacial zone at altitudes of 3700, 3850 and 3950 m was studied. Ice movement was measured monthly. A phototheodolite survey was made on the glacier snout. In collaboration with the Leningrad University Expedition, radio soundings were made and the stratigraphy of firn and ice studied by means of palynological analysis. The Leningrad University Expedition carried out traverse investigations on the Petrov glacier and studied the hydrological regime of glacier rivers, the evaporation and melting of snow on the glacier surface and the characteristics of radiation.

(4) The Department of Glaciology, Institute of Geography, Academy of Sciences, USSR, carried out investigations on the surging glaciers of the Pamirs (Medvezhy, RGO) and the Tien-Shan (Mushketov). Morphology and dynamics were studied on the basis of stereoresurveys and geodetic measurements. Surface ablation, glacio-geomorphology and hydrology on and under the glacier were studied. It was established that glacier surges at a speed 1-2 orders higher than usual were caused by relaxation of stress which had accumulated in glacier bodies for some time. A supposition was made that the next surging could be expected in 1974-1975.

(5) The Pamirs Aeroglaciological Expedition, Institute of Geography, Academy of Sciences, USSR, continued investigations of the surface regime in the accumulation areas of some glaciers in the river basins Surkhob and Obikhingou. In the Vakhan range the values of evaporation from the firn at high altitudes were determined and observations of the mechanism of the formation of penitentes were made. In the region of the lake Kara-Kul observations of the character of nourishment and ice formation were made on two glaciers at altitudes about 5000 m asl. A high intensity of accumulation was proved for the first time by means of instruments.

ALTAY

(1) Tomsk University carried out investigations in two alpine regions: in the representative mountain glacier basin of the river Aktru and in the basin of the river Multa. In the Aktru basin five additional observation stations were set up, the highest at an altitude of 3250 m making a total of 8 stations.

The following investigations were carried out: meteorology; velocity of the Levyy and Malyy Aktru glaciers and velocity of sliding between layers; ablation; measurements of firn banks and ice aprons by means of artificial glacier tables and screening of stakes from direct sun rays; snow surveys up to the height of 3300 m at the beginning and at the end of the season; glacier retreat (in particular, retreat since 1924 of Maashay glacier). In the basin of the river Aktru and neighbouring areas the processes of slope development and the dynamics of the moraine cover were observed.

The observations showed that the glacier module of run-off at the point where it came out from under the Pravyy Aktru glacier (11.5 km^2) in August was from 200 to 400 $l/sec.km^2$. The calculated annual module of the run-off was about 42 $l/sec.km^2$. A very interesting result was obtained from the experiment of stake screening: on an absolutely clear day in the total value of ice melting (8 cm), the share of direct radiation was 5 cm, scattered radiation 0.6 cm, turbulent heat exchange 2.4 cm. The value of annual accumulation in the firn area of the Malyy Aktru glacier was about 100 g/cm^2 (pit measurements).

(2) The Sector of Geography, Academy of Sciences, Kazakh SSR, carried out investigations on the Berel glaciers. Distribution and water content of the snow cover in the accumulation areas of the glaciers were studied. Other work included ice ablation studies, levelling of the glacier surface at fixed profiles, tachymetric

surveys of glacier snouts, and several meteorological actinometric and gradient observations. A group of scientists from the Institute of Geography, Academy of Sciences, USSR, also carried out observations to help the compilation of an inventory of glaciers in the Suntar Khayata range.

POLAR URALS

The Glaciological Department of the Institute of Geography, Academy of Sciences, USSR, took over investigations in the representative mountain glacier basin of the river Bolshaya Khadata. In this basin the following investigations were completed: snow surveys, observations on a network of precipitation gauges, measurements of glacier ablation, balance of heat and humidity in the layer of wind snow transport up to a height of 10 m. It was shown that even in the most favourable weather (clear and dry) the evaporation losses from the snow storm layer were very slight and could hardly explain, as previously supposed, the often observed differences between the values of snow storage and hard precipitation.

KAMCHATKA

The Institute of Vulcanology, Academy of Sciences, USSR, with the aim of choosing a typical glacier for permanent observations of its variations, investigated Elizovskiy (Avacha volcano) and Kozelskiy (Kozelsk volcano) glaciers. A snow survey in the accumulation area across two profiles was made and the value of snow accumulation in 1969-70 determined. On the basis of aerial photographs a map of Kozelskiy glacier was compiled. In the region of the volcano Avacha observations of the melting of seasonal and perennial snow banks were carried out.

ANTARCTICA

Glaciological investigations were carried out in the regions of the stations Molodezhnaya, Vostok, Mirny and Bellingshausen. Near the station Molodezhnaya the following work was done: snow surveys on a 200 km profile and on snow banks; temperature of snow thickness in pits (depth 27 m); velocity of glacier margins (by geodetic methods); stratigraphy in pits; inner structure of the glacier; and experimental soundings near crevasses by radio methods. Experimental investigations were carried out into means of determining glacier velocity by the doppler effect in lasers.

At Vostok station 510 m of thermo-drilling with a selection of cores was completed, and stratigraphic, crystallographic and chemical investigations were made. Ice temperatures, intensity of accumulation, crystallomorphology and chemical composition of precipitation were studied. During the summer season a snow survey profile from Mirny to Vostok was set up.

At Bellingshausen station measurements included accumulation and ablation, stratigraphy of snow-firn thickness in 10 pits, and velocities of surface ice layers on a control section.

V. M. Kotlyakov

U.S.A.

DECEPTION ISLAND AND LIVINGSTON ISLAND, SOUTH SHETLAND ISLANDS

Heat and mass balance and strain studies at Deception Island were carried out for the third consecutive year during the 1970-1971 austral summer by an expedition from the Institute of Polar Studies, The Ohio State University. The glaciological group, consisting of O. Orheim and T. Hughes, were joined by L. Govorukha from the Soviet Union for part of the field work, and together formed one section of the first International Deception Island Volcanological Expedition.

The glacier under detailed study had a more negative mass balance in 1970-1971 than in the previous two balance years, due mainly to a more negative summer balance in 1970-1971. The mass balance history for Deception Island was extended back to about 1750 by studies of the annual dirt layers exposed in the walls of a 100-m-deep crater formed in a glacier by the 1970 volcanic eruption. These dirt layers are very well developed because of the large amounts of dust blown on to the glaciers in the summers. Only the upper half of the crater section was fully studied during this season. It is expected that the mass balance history of the area will be extended back for several more centuries by further field studies during 1971-1972.

A mass balance program was started on the small ice cap terminating on Byers Peninsula on Livingston Island in order to compare the mass balance conditions of this area with those of Deception Island. The work this season indicates that, for the same elevations, the two areas experience similar winter balances. Summer balances are more negative at the Deception Island glaciers, however, because of the lower surface albedos.

Olav Orheim

NONHOMOGENEOUS STRAIN STUDIES FROM DECEPTION ISLAND

As one of The Ohio State University Institute of Polar Studies glaciologists participating in International Deception Island Volcanological Expedition organized to study the 12 August 1970 eruption, I made preliminary studies of a

new crater blasted through the tongue of a glacier flowing toward Telefon Bay from Binon Hill. The crater is now being closed by the ordinary flow of the glacier and by the localized stress field which is created around a cylindrical cavity in a viscoplastic material such as ice. Counteracting this activity, the crater is being kept open by ablation and calving from the crater walls. Calving is along steeply rising shear planes which intersect the crater wall at acute angles. Further studies are contemplated, involving surface strain measurements around the rim of the crater to determine the closure strain rate field, mass balance studies around the crater walls to determine the ablation field, and laboratory-field studies of the shear planes around the crater to study the calving dynamics.

T. Hughes

JOHANNES WEERTMAN

Johannes Weertman's parents were Dutch, and they emigrated to the U.S.A. in the early 1920's. Hans was born in Fairfield, Alabama, on 11 May 1925, but spent most of his early years in Beaver, Pennsylvania, a few miles south of the limit of the North American ice sheets. His father, a retired civil engineer, now uses his creative abilities to make cellos, violas and violins, and Hans' brother Willem, who also trained as an engineer, holds the position of assistant chief motor engineer in the Chrysler Corporation. Hans' interests lay, however, in physics and he gained his degrees in that subject at the Carnegie Institute of Technology.

In 1950 he married Julia Randall, a fellow graduate student in solid state physics at Carnegie, where they both obtained D.Sc. degrees in 1951. Later that year they went to France to study at the Ecole Normale Supérieure in Paris, Hans on a Fulbright Fellowship, Julia on a Rotary International Fellowship. From 1952-58 they worked in Washington, D.C., at the U.S. Naval Research Laboratory. They went abroad again at the end of 1958, when Hans was appointed Scientific Liaison Officer for the U.S. Office of Naval Research at the American Embassy in London. On their return to the U.S.A. in 1959, they lived in Illinois, for Hans had joined the Department of Materials Science in Northwestern University at Evanston. In 1960 he was appointed to a full professorship in that department and, in 1963, to one in the Geology Department. In 1964 he became Chairman of the Department of Materials Science, a position he still holds. In 1968 he was appointed to a Walter P. Murphy Professorship at Northwestern—these professorships were created in 1950 as a memorial to the man who gave funds for the construction and endowment of the University's Technological Institute.

In addition to his teaching and research, Hans was a consultant to the Bain Laboratory of the U.S. Steel Corporation, 1960-62, and to Oak Ridge National Laboratory, 1963-68. He is at present a consultant to the U.S. Army Cold Regions Research and Engineering Laboratory and to the U.S. Naval Research Laboratory, both since 1960, and to the Los Alamos Science Laboratory since 1967. The expertise that he has to offer these organizations and his students at Northwestern is mainly concerned with the physics of metals: creep of crystals, internal friction, fatigue cracks and the influence of the atmosphere on their growth, the dislocation morphology of fatigue, experimental studies of high-speed dislocations, and theoretical studies using the concept of infinitesimal disclocations. He is the author of many articles on these subjects, and with his wife wrote a book, published in 1964, that has become a classic in its field, *Elementary Dislocation Theory.*

Glaciologists know him for his articles on specialized aspects of ice mechanics, and may wonder at what point in the distinguished career described briefly here did he begin to take an interest in glaciology. It was apparently a chance conversation in 1956 with Prof. Peter Haasen, who was at that time working in Chicago University. He pointed out that Weertman's experimental work on the creep of metals was showing results comparable to those obtained by John Glen in Cambridge, England, in his work on the creep of ice. In 1958 the Weertmans moved to London and, during the year they spent in England, Hans was able to discover more about the characteristics of ice. He talked at length with John Glen and John Nye, attended meetings of the Glaciological Society, and met glaciologists from several countries. In succeeding years his interest in deformation problems as applied to ice grew considerably, and he contributed many articles on this subject to the *Journal of Glaciology.* Much of his consulting work for CRREL has been in this field.

His most important recent work in glaciology has been concerned with the development of a unified theory of the flow of water at the base of an ice sheet or glacier. Much of the work for this was done during a sabbatical year, 1970-71, when he held a Guggenheim Fellowship and spent the time in Cambridge, England, with his wife and two children, Julia and Bruce. It was a year when the Scott Polar Research Institute was happy to be host to three glaciologists who have made important and widely differing contributions to the discipline. His aim in developing the unified theory was to bring about a more enlightened understanding of surging glaciers and surging ice sheets, as well as of the seasonal variations of the movement of glaciers. He was working also on a theory of water flow at the base of a glacier or ice sheet which rests on permeable till rather than on a water-tight rock bed, recognizing that both types of surface exist under glaciers and ice sheets.

As a member of the Council of the Glaciological Society, Hans attended its meetings in the U.S.A., U.S.S.R. and Britain. He has contributed to the Society's lecture programme, and joined many other groups for discussions. His contributions to glaciology, both written and spoken, are known for their consistently high quality and nicely calculated brevity. Quick reactions and a quiet persistence in debate make him a formidable protangonist in those verbal duels with the few glaciologists who work in the same highly specialized part of the subject. But his soft-spoken comments reveal a lively humour that delights his colleagues and adds to their appreciation of the delight he takes in his own work.

GLACIOLOGICAL SOCIETY

Conversation pieces at the annual dinner in Moscow, August 1971

▲ F. Müller and the Secretary

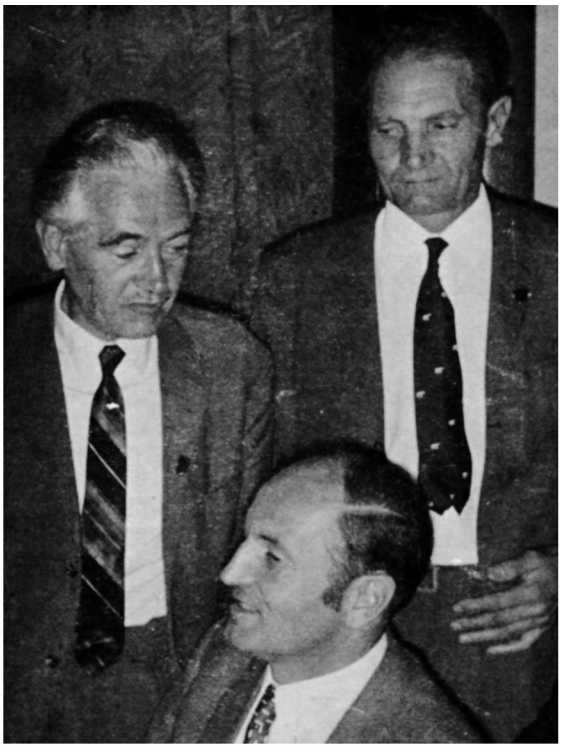
▼ L. Lliboutry, Mrs Lliboutry, W. Budd

▲ The President and V. Kotlyakov

▲ J. F. Nye and Mrs Schytt

◀ M. Grosswald and Mrs Schytt

▼ Mrs Hoinkes, Mrs Field and W. O. Field



▲ M. Zalikhanov, U. Radok, P. Shumskiy, A. Bazhev and V. Kotlyakov

◀ H. Hoinkes, O. Reinwarth, W. H. Ward

▼ G. de Q. Robin and C. P. Vohra

▲ A Vice-Presidential pair — J. W. Glen and M. de Quervain

F. Müller, L. Gold, the Secretary, B. Salm,
▼ A. Dyunin and friends from Novosibirsk

Photographs by Achim Karsten

NEWS

SELIGMAN CRYSTALS. We are pleased to announce that the Council of the Society agreed in August 1971 to award Seligman Crystals to B. Lyle Hansen and John Glen. The Crystals will be presented during the Annual Conference, 20-21 April 1972, in Cambridge, England, and we hope that many members will be present on this occasion. Mr Hansen's award is made in recognition of his several contributions to glaciology and particularly for his development of the deep drilling equipment which has in a unique way enriched glaciological science. Dr Glen's award is made for both his scientific work and his services to glaciology in editing and other work for the Journal of Glaciology over many years.

The Seligman Crystal is the premier award in glaciology. It was instituted in 1967 and is awarded "from time to time to one who has contributed to glaciology in a unique way so that the subject is now significantly enriched as a result of that contribution." Previous recipients are Gerald Seligman, Henri Bader and John Nye.

ANNUAL GENERAL MEETING 1971

MINUTES OF THE ANNUAL GENERAL MEETING OF THE GLACIOLOGICAL SOCIETY 10 AUGUST 1971 AT MOSCOW STATE UNIVERSITY, MOSCOW, U.S.S.R.

The President, Dr V. Schytt, was in the Chair.

1. The Minutes of the 1970 Annual General Meeting, published in ICE No. 33, August 1970, were approved, and signed by the Chairman.

2. The President gave his report for 1970-71.

My last report to you was given in Cambridge in May last year. It dealt with the editing of the Glacier Hydrology Proceedings; with the heavy burden carried by our editors, with the increased membership, with the good international coverage, with our plans to have a joint meeting with the Icelandic Glaciological Society, with our finances and with the expanded AGM which gave us two days to meet colleagues, present new results and discuss our problems.

Now, 15 months later, it is time to look back and see how much further progress we have made along these lines—if any at all.

The edited copy of the 1969 Symposium proceedings was sent to the publisher last August, but unforeseen difficulties in IASH have led to a very serious delay, and we have not even seen the proofs yet. This is very unfortunate for the contributors as well as for the members waiting for their copies. And it must be terribly disappointing to our Editors, who had had to double their efforts in order to produce two large volumes in one year—both the Proceedings and the ordinary Journal.

I said last year that anything we could do to ease the Editors' work would be given the highest priority by the Council. That is easy to say to an AGM—it is far more difficult to find the ways and means to do it. We have been able to provide our Editors with one more assistant. We know that that is far from enough—we want to do much more, because we have an unusually competent team running our Journal, and we want them to continue.

The Journal is the most important result of the Society's work, but the whole basis for our activity is of course our members. A better and better Journal will help us to increase the membership, and an increased membership will help to further improve and expand the Journal. In May this year we had 939 members—76 more than the year before—and the total circulation of the Journal was 1,595. I can see many different ways to increase our membership to over 1,000 before we meet next year—if the currency problems could be solved and our Russian colleagues could join the Society, we could pass 1,000 this very week.

This Society has accepted that glaciology deals with all aspects of snow and ice, but our contacts with the people involved in applied research have been weak, and you have not seen much of applied glaciology printed in the Journal. Our Secretary, who is our best ambassador, attended the Symposium on "Ice and its action on hydraulic structures", organized by the International Association of Hydraulic Research in Iceland in September 1970. This was one initiative in the right direction—and some new members were gained—but we will have to do more. We must encourage research workers dealing with basic research as well as applied research to publish in our Journal—we want the theoreticians and the practical field men to

contribute, and we want articles on ice whether it is above, on or below the ground or the water surface.

We are not, however, just a publishing house —we hold several meetings each year, in different countries. The annual conference, which was expanded to two days last year, was held in Cambridge this April. Members from eight different countries joined in the two days of talks and discussions and in the social occasions. Members in the north-east of North America attended a week-end meeting of their local branch of the Society this spring, and in June 1970 we held a week's meeting in Iceland with members of the Icelandic Glaciological Society. It is likely that in the future we shall have meetings in many other countries, for branches of the Society seem to be proliferating: our members in France are in the middle of creating a branch there, and three other areas (one national, two regional) have expressed their intention of forming branches. We hope that our branches will stimulate interest in the many aspects of glaciology, and bring in new members and authors. So far our branches seem to specialize in the holding of informal meetings, free of the need to submit formal abstracts and free of the threat of definitive publication soon after the meeting: rather do our branches emphasize the importance of informal meetings with plenty of time for discussion and for the airing of new ideas and theories.

Your Council has had a busy year, for we are considering changes in the Constitution of the Society, changes that we feel necessary after 10 years of operating our present Constitution. We aim to keep up with developments in the international scientific world and should let our Constitution reflect those changes. You will be receiving ballot papers about the changes very soon. We are also considering the best way to celebrate the Society's 40th birthday, which will take place in 1976, and will probably do as we did for our 25th birthday—hold a symposium on a topic of particular importance for that time.

As you will hear from the Treasurer's Report the Society's finances are fairly satisfactory. You can compare them with a little ice cap with negative mass balance but with enough volume to be able to take moderate losses over a limited time. But a negative balance must not be permitted to continue too long and the Council has the means to change the climate by increasing the amount of solid precipitation. We have decided on an even number of 66.67%. That should give us a positive balance for a few years until the general deterioration, also called inflation, catches up with us again.

On the whole, I think that the prospects are good, that our Society will continue to grow and be able to expand its services to the international scientific world. We had just entered into a period of intense expansion in the polar regions, and more and more practical problems concerned with ice will have to be solved. We have to do everything possible to keep basic and applied research close together—to their mutual benefit. Our Journal may change slightly in character, but may our Chief Editor protect us from a Journal that never changes at all. We have the tail wind—let us hope that we can find the best sail combination and steer the best course.

When I give my last President's Report, wherever it will be, next Spring or next Summer, I would like to report to you that we are more than 1,000 members, that significant steps have been taken to improve our editing facilities but with less work for our Editors, that a number of valuable papers in applied glaciology have been delivered to the Journal, and that approximately 100 Soviet glaciologists have joined the Society.

3. The Treasurer, Dr J. A. Heap, was unable to be present at the Meeting; his report was read by the President.

The accounts for 1970 show that the Society operated last year at a loss of just over £1,000. This deficit is the sum of an expected loss of £273 together with a paper transaction by our accountants by which the cost of part of our stock publications was allocated to 1969 whereas it should have been allocated to 1970.

Considering the way in which the income and expenditure of the Society had risen in relation to each other over a number of years it was clear to the Council that the time had come to increase the subscriptions to the Society. This step was taken regretfully but we had to take into account the slight loss in 1970 and the expected greater loss in 1971. The Council therefore agreed to raise the subscriptions for the first time in seven years. The new rates are as follows:

Ordinary members	£5.00
Junior members	£2.00
Library subscribers	£10.00

The Society's ability to continue the process of improving services to its members without frequent increases in subscription rates depends entirely on a steady increase in the membership. Although the increase has been reasonable over the past few years it has not been sufficient to balance the effects of rising costs. I hope that members of the Society will do all they can to encourage their colleagues to join the Society and to encourage their libraries to subscribe to the *Journal*.

In agreeing to the new subscription rates the Council noted that the number of pages of the *Journal* in 1964—the year immediately before the last increase—was 382 and that the number of pages during 1969 and 1970 averaged 480. It was also noted that the cost of each page of the *Journal* over this period had increased from £6 to £10. I believe it is true to say that these 480 pages are extraordinarily cheap when compared with current book and scientific journal prices.

The increase in the size of the *Journal* is primarily a reflection of the growth of interest in glaciology. The increasing interest in snow and ice, in all its forms, especially in relation to polar engineering and technology, suggests that the subject will grow rapidly in importance and scope over the next few years. If the Society is to be in a position to take advantage of this growth and, in particular to attract membership from the engineering and associated technological fields, it must be able to provide the additional services required.

When the Society began, the necessary secretarial and editing services were usually unpaid and were provided out of a sense of loyalty to the Society. It is more than good to be able to say, as I am sure you are all aware, that this loyal—although underpaid—service to the Society has continued and that the Society has prospered as a result. But the Council feel that we should now move progressively towards a position where the labourers are paid the hire of which they are undoubtedly worthy. It is, of course, impossible to evaluate in any strict sense the enormous services provided to the Society by the Secretary, by the Editors of the Journal and by their advisers. But the Council is strongly of the opinion that provision should be made for the Secretary of the Society to be paid a rate more consistent with her job and for the secretarial and other professional support for the Editors to be increased. To do this is only prudent. We need to pay for our professional services at a rate which, in the event of any of the present incumbents leaving the service of the Society, would enable us to obtain similar standards of service without producing an unacceptable strain on the Society's resources.

To sum up, the Society's financial position is basically sound, since savings in previous years will enable us to carry the current deficits. Rising costs and the need to prepare the Society to cope with future growth indicate the need to increase subscriptions and to increase the memberships of the Society.

4. Election of auditors for the 1971 accounts
   Dr J. F. Nye proposed and Dr G. de Q. Robin seconded that Messrs Peters, Elworthy and Moore, of Cambridge, be elected auditors for the 1971 accounts. This was carried unanimously.

5. Elections to the Council 1971-74
   After circulation to all members of the Society of the Council's suggested list of nominees, no further nominations had been received. The following people were elected unanimously:
   Elective Members W. Ambach
   W. Dansgaard
   E. R. LaChapelle
   G. de Q. Robin
   The President thanked the retiring Council members for their three years of service: P. Kasser, N. Untersteiner, J. Weertman.

6. Appointments to Posts and Committees
   Under Rule 10 of the Constitution, the Meeting confirmed the appointments made by the Council in the past year for service during the year:
   Special Post of Founder — Gerald Seligman.
   Awards Committee — H. C. Hoinkes, M. F. Meier, J. F. Nye, the President (ex-officio), the Secretary of the Society as secretary.
   Library Committee — J. W. Glen, B. B. Roberts, the Treasurer (ex-officio), the Secretary of the Society as secretary.
   Research and Education Fund Committee — Sir Vivian Fuchs, J. F. Nye, H. Röthlisberger, A. L. Washburn, the President (ex-officio), the Secretary of the Society as secretary.

The meeting was followed by a dinner, held in the Prague Restaurant in the city of Moscow. About 140 members and visitors were present, and, as can be seen from the photographs in this issue of ICE, a happy time was had by all. By holding our meeting and dinner in Moscow during the period of the IUGG XV General Assembly, several members who normally cannot be present at our functions were able to attend. We were also able to enjoy the company of our Soviet colleagues, the majority of whom are unable at present to be members of the Society because of currency restrictions. We hope that, for one evening at least, they felt they were members of the Society.

FUTURE MEETINGS

1972 ANNUAL CONFERENCE

The conference, with Annual General Meeting and dinner, will be held in Cambridge, England on April 20 and 21. The meetings will be held in the Scott Polar Research Institute, by kind permission of the Director. On the evening of 20 April there will be a dinner and on the evening of 21 April there will be an informal party. Full details will be circulated to members later. The Council of the Society will meet on 19 and 22 April. Booking forms will be circulated later.

If you have some interesting new work to talk about, please let the Secretary know as soon as possible. We aim to make this annual conference informal, with no written abstracts to submit beforehand and no publication of proceedings afterwards. The maximum time for presentation is 20 minutes, but many talks are shorter — some comprising the showing of two or three slides of a feature that has puzzled the observer, some pointing out the need for work on a particular topic, some showing a new instrument that is proving useful. Let us know if you would like to give a talk — and if we are inundated with replies, then we will extend the duration of the meeting!

COUNCIL ELECTIONS

At the Annual General Meeting each year, the elections take place for those Council vacancies occurring at the meeting. These vacancies include Elective Members and, in most years, Officers. The procedure for nomination begins months ahead, and during the period laid down in the Constitution every member of the Society has an opportunity to participate. An initial list of nominees is drawn up by the Council (with the aid of its Nominating Committee), taking into consideration the scientific and other expertise needed on the Council, the desirability of drawing in different countries into the administration of the Society, and so on. There is a constant search to bring in new blood and new aspects of glaciology. Furthermore, the Council must be able physically to meet at least once a year. In order to achieve the necessary quorum of 6 people, Council meetings are arranged for the periods of our Annual Conference and of any other international conference likely to attract the attendance of glaciologists. Nominees must therefore have some reasonable chance of attending such conferences, at least until the day when the Society will be rich enough to pay the travelling expenses of its Council members. When considering possible nominees for Officers, service during previous terms on the Council is taken into consideration. Care has also to be taken not to exceed the maximum terms of service laid down in the Constitution: not more than 3 consecutive years as an Elective Member, not more than 9 consecutive years in total without a break of one year.

Once the Council has agreed upon its nominees, the list is circulated to all members of the Society, who may then submit other nominations in accordance with the Constitution. If extra nominations are submitted, then in due course a postal ballot takes place. By the time the Annual General Meeting is held, every member has been apprised of the Council's nominees, been given the opportunity to submit others, and, if a vote is necessary, been given the opportunity to vote by post. No additional nominations may be made at the Annual General Meeting, for those many members who cannot attend that meeting would thereby be deprived of the opportunity to vote.

— In all, a more democratic system than obtains in many organizations.

The Council's Nominating Committee is always glad to receive names of people whom it can consider. At the 1972 A.G.M. 4 Elective Members will be needed, for service on the Council 1972-75. If you have any suggestions, please send them to the Secretary as soon as possible. The current list of Council members is printed inside the back cover of this issue of ICE.

THE LIBRARY

BOOKS RECEIVED

H. R. Bárðarson. *Ice and fire: contrasts of Icelandic nature.* Reykjavík, H. R. Bárðarson, [c1971]. [iv], 171 p.

[Descriptions of glaciers, ice caps, snow and ice formations, sea ice and volcanoes, illustrated by numerous coloured and black and white photographs.]

K. W. Butzer. *Environment and archaeology. An ecological approach to prehistory. Second edition.* Chicago and New York, Aldine-Atherton, [c1971]. xxvi, 703 p.

[Concerned with interaction of man with his environment, depending on his technology and organizational skills, and application of this to the study of prehistory. Includes sections on: vegetation, soils and geomorphology as environmental indices; interpretation of Pleistocene sediments; contributions of the biological sciences; some Pleistocene environments of the Old and New World; man-land relationships in prehistory.]

J. C. Doornkamp *and* C. A. M. King. *Numerical analysis in geomorphology: an introduction.* London, Edward Arnold, [c1971]. xi, 372 p.

[Deals with drainage basins, slopes, coasts, and glacial landforms. Over forty techniques are described.]

R. F. Flint. *Glacial and Quaternary geology.* New York, etc., John Wiley and Sons, [c1971]. xii, 892 p.

[Combines systematic treatment of processes of glacial geology with stratigraphic, environmental, and historical discussion of the Quaternary, with some emphasis of new (post 1950) techniques.]

International Association of Hydraulic Research. *I.A.H.R. symposium. Ice and its action on hydraulic structures, Reykjavík, Iceland, [8]-10 September 1970.* [Delft, International Association of Hydraulic Research, 1971.] [iv], variously paged.

[Sessions: ice terminology and measurements; ice formation and properties; ice formation and break-up; ice control at power plants; mechanical properties of ice and interaction on structures; forces exerted by ice on structures.]

L. O. Quam, *ed. Research in the Antarctic. A symposium presented at the Dallas meeting of the American Association for the Advancement of Science—December 1968.* Washington, D.C., American Association for the Advancement of Science, [c1971.] xv, 768 p., separate map.

[Comprehensive reports of multidisciplinary research and its global significance. History, biology, glaciology, climatology, conjugate phenomena, ocean dynamics, Gondwanaland.]

G. K. Tushinskiy, *ed. Lavinoopasnyye rayony Sovetskogo Soyuza* [*Regions of the Soviet Union where there is danger from avalanches*]. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1970, 199 p.

[Estimated danger in various mountain areas.]

We are grateful to the donors of reprints, pamphlets, maps, expedition reports and other material. Glaciological works, with complete references, will be listed in *Glaciological Literature* at the end of the *Journal of Glaciology* and kept in the Society's collection for the use of members.

FUTURE MEETINGS

POLAR DESERTS SYMPOSIUM
COMMITTEE ON ARID LANDS

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

(Philadelphia, Pennsylvania, USA, 26-31 December 1971)

Polar desert areas, like those in the Temperate and Tropic Zones, have a delicate balance between the climatological, geological and biological processes. The discovery of minerals and other natural resources in these areas is attracting increasing numbers of people who will, without question, disturb the natural but delicate balance existing between these processes. Man's move into the polar deserts must be made with considerable caution if he is not to do irreparable harm.

The American Association for the Advancement of Science's Committee on Arid Lands believes that many of the lessons we have (or should have) learned in our long and continuous use of hot and warm deserts can be, in general, applied to our increasing use of the cold ones. The Committee is, therefore, organizing a symposium on POLAR DESERTS to be held in Philadelphia, Pennsylvania, during the annual meeting of the American Association for the Advancement of Science, December 26-31, 1971. The exact date for the symposium has not as yet been determined.

Several symposia on polar studies have been held during the past 2 or 3 years in which aspects of the natural environment have been discussed and reported. We do not want to duplicate what was discussed during these meetings. Rather, the organizers of this symposium hope that here we can explore the similarities and differences between the polar deserts and the low latitude deserts with special note on how we might apply knowledge gained by the long history of occupation of the latter areas. We also hope to develop discussion on the natural polar desert environment phenomena as they affect man; the stresses on the environment by society, and the stresses the environment will have on society, must be considered. This development should include economic, social, recreational, and demographic aspects, and the physical and biological processes that either influence or are influenced by intensified development.

For this symposium we propose the following definition of a polar desert: a polar desert is a glacier-free terrestrial area wherein the mean annual precipitation is less than 25 cm, and the mean temperature for the warmest month of the year is less than 10°C (this figure is quite arbitrary and therefore is not to be construed as a rigid constraint). Tundra areas which essentially meet these conditions are included in this definition, e.g. the Arctic Slope in Alaska. Other physical characteristics of a cold desert would be much like those described by J. C. F. Tedrow in "Soil Investigations in Inglefield Land, Greenland," **Meddelelser om Grønland,** Kommissonen for Videnskabelige Undersøgelser I Grønland, Bd 188, Nr 3, 1970, pp 37-83, and by R. E. Cameron, et al, "Soil Microbial and Ecological Investigations in the Antarctic Interior," **Antarctic Journal** of the US, Vol V, No 4, pp 87-88, 1970.

TENTATIVE PROGRAM

I — Introduction

II — The natural environment of polar deserts:
1. Climatology
2. Geologic and geomorphic processes
3. Hydrology and limnology
4. Soils and soil genesis
5. Microbiology and ecology
6. Macrobiology and ecology

III — Indigenous peoples of polar deserts—a review

IV — Economic base for development of polar deserts:
1. Processes and costs imposed by environmental stress
2. Historical aspects of resource development
3. Current aspects of resource development
4. Prospects for future development

V — Problems of immigrants in polar deserts
1. Housing problems
2. Health and sanitation problems
3. Communications and transportation problems
4. Urban development problems
5. Social and civic problems

Terah L. Smiley
James H. Zumberge

Further information may be obtained from Dr J. H. Zumberge, Director, School of Earth Sciences, University of Arizona, Tucson, Arizona 85721, U.S.A.

CANADIAN NORTHERN PIPELINE RESEARCH CONFERENCE, 1972

Research in northern Canada related to pipeline design and construction will be reviewed and discussed at a conference to be held in Ottawa on February 2, 3 and 4, 1972. The conference is being convened by the Associate Committee on Geotechnical Research of the National Research Council of Canada with the support of the Departments of Energy, Mines and Resources, of Indian Affairs and Northern Development, of the Environment, and the National Energy Board.

Technical aspects of research into all aspects of northern terrain will be discussed by speakers from industry, universities and government. Much has already been accomplished, much still remains to be done. It is intended that, in addition to reviewing work now in progress, the conference will point the way to areas in which research is still needed in view of current northern activity and of the decisions that have to be faced in connection with pipelines for gas and oil.

Meetings will be held at the Skyline Hotel, Ottawa. Chairman of the Organizing Committee is Dr R. F. Legget, formerly Director of NRC's Division of Building Research. Secretary for the conference is Ivan C. MacFarlane to whom inquiries should be addressed c/o Associate Committees' Secretariat, National Research Council of Canada, Ottawa, Ontario, K1A 0R6, Canada.

SYMPOSIUM ON THE PHYSICS AND CHEMISTRY OF ICE, 1972

(extracts from the Second Circular)

The Symposium is sponsored by the Royal Society of Canada and supported by grants from the National Research Council of Canada, Inland Waters Branch of the Canadian Federal Department of the Environment, Arctic Petroleum Operators Association and the Eastcoast Petroleum Operators Association.

The Symposium will be held on the campus of Carleton University, Ottawa, 14-18 August 1972. Participants and their families will be accommodated in Glengarry House, an air-conditioned dormitory completed in 1969. Meals will be available in a cafeteria adjoining Glengarry House.

Technical sessions will be held on campus. They are expected to start at 9.00 a.m. Monday, 14 August and end at 5.00 p.m. Friday, 18 August.

Note: An international symposium on hydrogen bonding will be held at Carleton University, 21 to 25 August, 1972. The two Symposia are being held in adjacent weeks so that those who wish to do so can attend both. Further details can be obtained from Mr M. K. Ward.

Programme

The Symposium will emphasize the fundamental physics and chemistry of ice in all its phases, including the clathrate hydrates. It is anticipated that the following topics will be included: molecular orbital theory, crystallography, thermodynamics of the pure phases and of phase transformations, molecular vibrations, surface properties, solutions in ice, electrical properties, nuclear and electron magnetic resonance, dislocations and mechanical properties, etc.

To date, the following persons have accepted invitations to give review papers: Prof N. Fletcher, University of New England; Dr J. W. Glen, University of Birmingham; Prof P. V. Hobbs, University of Washington; Prof B. Kamb, California Institute of Technology; Prof J. F. Nye, University of Bristol; Prof L. Onsager, Yale University; and Prof J. Weertman, Northwestern University.

Papers

Titles and abstracts (maximum 200 words) of papers to be considered for inclusion in the Symposium should be submitted to the Executive Secretary before **15 December 1971.** The final paper (maximum 2,500 words plus four figures) should be submitted before **1 May 1972.** The papers will be preprinted by photo-offset and distributed prior to the Symposium to allow as much time as possible for discussion. Authors will receive details of the required format of the final papers when they are notified of the acceptance of their papers. A final printed proceedings will be published which will include written discussion.

For further information, please write to:
Mr M. K. Ward, Executive Secretary,
International Symposium on the Physics and Chemistry of Ice,
c/o National Research Council of Canada,
Ottawa, K1A OR6, Canada

SYMPOSIUM ON ICE AND ITS ACTION ON HYDRAULIC STRUCTURES

(Leningrad, USSR, September 1972)

The Symposium, organized by the Committee on Ice Problems of the International Association for Hydraulic Research, will take place in Leningrad, USSR, 26-29 September 1972. Tours are planned after the Symposium. The following details are extracted from the first circular.

The purpose of the Symposium is to promote international co-operation between engineers and scientists engaged in the field of ice engineering and united at the 1st Symposium which was held in Reykjavík, Iceland, 1970. The Organizing Committee invites contributions to the following subjects:

1. Structure, physical and mechanical properties of ice, including procedures and apparatus for their measurement both in the laboratory and in the field.
2. Freezing and break-up on natural rivers and reservoirs with ice obstructions and jams taken into account.
3. Ice regime and control in the vicinity of hydraulic structures including preventive measures against harmful effect of ice on the structures and the ways of prolonging the navigation period.

Pre-registration must be made on the postcard which accompanies the circular, obtainable from: Mr B. P. Lebedev, Committee for the USSR Participation in International Power Conferences, Sovmek, 11 Gorky Street, Moscow K-9, USSR.

Further information on the Symposium will be supplied by the Organizing Committee only to pre-registered participants.

Papers written either in English or in French should be sent to the address indicated above not later than the **Ist January 1972.**

No paper shall exceed 5 pages including the title page with the English and French synopses, illustrations and photographs.

SYMPOSIA ON THE ROLE OF SNOW AND ICE IN HYDROLOGY

(Banff, 6-20 September 1972)

Symposium on Properties and Processes (convened by Unesco)

Symposium on Measurement and Forecasting (convened by WMO)

Extracts from Information Note No. 1 were published in the last issue of ICE (No. 35, p. 28-29). Information Note No. 2 has now been published, and may be obtained from Dr I. C. Brown, Chairman, Organizing Committee, Int. Symposia on the Role of Snow and Ice in Hydrology, c/o Dept. of Environment, No. 8 Building, 870 Carling Avenue, Ottawa, Ontario, K1A 0E4, Canada. The Note includes instructions to those wishing to submit papers, which should be received by **31 January 1972,** and a Provisional Registration Form. Only those people who submit these provisional forms will receive Information Note No. 3, which will give details of the programme and a final registration form.

INTERNATIONAL RADIO CARBON DATING CONFERENCE
THE ROYAL SOCIETY OF NEW ZEALAND

(Lower Hutt, New Zealand, 18-25 October 1972)

OBJECTIVES AND PROGRAMME

1. The intention of the Carbon Dating Conference is to bring together a significant proportion of the people who are actively engaged in operating dating laboratories. There are over 100 of these laboratories in the world and it is expected that a reasonable number will be represented at the conference.
2. The composition of the intended programme is designed to deal with technical laboratory aspects and the significance of the isotopic ratios measured in the estimation of the carbon-14 date.
3. It is not intended to devote the conference to discussions on actual projects which use carbon-14 dates merely as an indicator of time supporting other geological or archaeological evidence, but rather the procedures that had to be adopted to validate the result.
4. There are a very large number of problems fundamental to the carbon dating method and to its correct interpretation requiring discussion. These will be covered in the conference programme.

TENTATIVE PROGRAMME

Part 1 — Technical Aspects:

Matters that affect arriving at a proper carbon-14 value

Radio carbon techniques.
Standards in dating.
The half life of carbon-14.
Secular variations of carbon-14.
International co-ordination of carbon-14 programmes.

Part 2 — Use Aspects:

Matters affecting the production of a significant carbon-14 date

Guidelines for evaluation of a carbon-14 project.
Selection of material for dating.
Problems of chronology using carbon-14
(a) 0—15,000 yrs.
(b) 15,000 yrs—limit.
Carbon-14 variations in the ocean and their effects on deep sea cores.
Carbon-14 in interpreting soil development.
The significance of carbonate content of groundwater.
Miscellaneous applications.

Please inform the Executive Officer of your interest in the Conference, and thus be sure of receiving the Second Circular. Executive Officer: Mr. G. W. Markham, Royal Society of New Zealand, P.O. Box 196, Wellington, New Zealand.

GLACIOLOGICAL DIARY

1971

26-31 December

Polar Deserts Symposium, Committee on Arid Lands, American Association for the Advancement of Science. Philadelphia, Pennsylvania, U.S.A. (Dr James H. Zumberge, College of Earth Sciences, University of Arizona, Tucson, Arizona, U.S.A.) (See p. 19 of this issue of ICE.)

1972

2-4 February

Canadian Pipeline Research Conference, Ottawa (I. C. MacFarlane, National Research Council of Canada, Ottawa, Ontario K1A OR6, Canada.) (See p. 20 of this issue of ICE.)

20-21 April

Glaciological Society Annual Conference, Cambridge, England. (Mrs H. Richardson, Glaciological Society, Cambridge CB2 1ER, England.)

10-17 August

International Geographical Union, 22nd Congress, Montreal, Canada. (Secretariat, 22nd International Geographical Congress, P.O. Box 1972, Ottawa, Canada.)

14-18 August

Symposium on the physics and chemistry of ice. Royal Society of Canada. (M. K. Ward, National Research Council of Canada, Montreal Road, Ottawa 7, Canada.) (See p. 20 of this issue of ICE.)

21-30 August

International Geological Congress, 24th Session, Montreal, Canada. (Secretary-General, 24th International Geological Congress, 601 Booth Street, Ottawa 4, Canada.)

6-20 September

Symposia on the role of snow and ice in hydrology. Banff, School of Fine Arts, Banff, Alberta, Canada. (Dr I. C. Brown, Secretary, Canadian National Committee for IHD, No 8 Building, Carling Avenue, Ottawa 1, Canada.) (See p. 21 of this issue of ICE.)

26-29 September

Symposium on Ice and its action on hydraulic structures, I.A.H.R. Leningrad, USSR. (Mr. B. P. Lebedev, committee for USSR participation in international power conferences, Sovmek, 11 Gorky Street, Moscow K-9, USSR.) (See p. 21 of this issue of ICE.)

18-25 October

Radiocarbon Conference, Royal Society of New Zealand. (Mr G. W. Markham, Royal Society of New Zealand, P.O. Box 196, Wellington, New Zealand.) (See p. 21 of this issue of ICE.)

1973

2-10 December

International Union for Quaternary Research, congress, New Zealand. (Dr Jane M. Soons, Secretary-General, Dept. of Geography, Univ. of Canterbury, Christchurch, New Zealand.)

NEWS

AWARDS

Dr Robert F. Legget, who retired last year after 23 years as Director of the National Research Council of Canada's Division of Building Research, has received honorary degrees from two British Universities: on 23 June 1971 a Doctorate of Law from the University of Glasgow, and on 10 July a Doctorate of Engineering from the University of Liverpool.

PUBLICATION

At the request of Dr H. Hoinkes, one of the two editors of the revived Zeitschrift für Gletscherkunde und Glazialgeologie, we are pleased to take this opportunity of reminding members that articles to that journal may be submitted in English.

Muskeg (peatland) and the critical North, with a bonus session on "Case Histories", was the theme of the Fourteenth Conference on Muskeg Research, held at Queen's University at Kingston, Ontario, Canada, May 10-11. In common with previous such conferences, engineering aspects of peatland access (e.g. road construction and off-road vehicles) was a major topic of discussion. Topics discussed at the Conference included thermal regime and peat constitution, *ice-biotic relationship in frozen peat,* muskeg as a climate control ecosystem, permeability considering structural viscosity changes and the deleterious effects of muskeg.

A full record of the Conference will be issued by the end of the year. Applications for a copy of the Proceedings should be directed to Miss J. Butler, Secretary, Muskeg Subcommittee, c/o Division of Building Research, National Research Council of Canada, Ottawa, Ontario, K1A 0R6, Canada.

NEW MEMBERS

Bárðarson, Hjálmar R., P.O. Box 998, Reykjavík, Iceland.

Behling, Robert E., Institute of Polar Studies, The Ohio State, University, Columbus, OH 43210, U.S.A.

Bevan, Alan, 74 Chester Street, Flint CH6 5DH, Wales.

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Hallet, B., 5630 W. 79th St., Los Angeles, CA 90045, U.S.A.

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Jenssen, Dr D., Meteorology Department, Melbourne University, Parkville, Victoria, 3052, Australia.

Kahane, Dr André, Spectrométrie Physique, Cedex 53, 38 Grenoble- Gare, France.

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Murphy, Martha D., Box 4113 Woodside, CA 94062, U.S.A.

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Posamentier, Henry, 2 Ellwood Street, New York, NY 10040, U.S.A.

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Suzuki, Sigenao, Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.

Tusima, Katutosi, Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.

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Wimer, Rodney D., 1318 1st St., Apt. No. 1, Cheney, WA 99004, U.S.A.

Yamada, Yutaka, National Research Center for Disaster Prevention, Institute of Snow and Ice Studies, 1st Section, 9628 Suyoshi-Machi, Nagaoka-Shi, Japan.

Zotikov, Igor, Institute of Geography, Academy of Sciences, Staromonetny 29, Moscow.

THE GLACIOLOGICAL SOCIETY

Cambridge CB2 1ER, England

SECRETARY: Mrs. H. Richardson

Council Members 1971 - 1972

			Date first elected to Council (in present term of service)
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VICE-PRESIDENTS	J. W. Glen	1970-73	1967
	M. de Quervain	1969-72	1969
	W. F. Weeks	1969-72	1969
TREASURER	*J. A. Heap	1970-73	1967
ELECTIVE MEMBERS	*C. S. Benson	1969-72	1968
	*A. Higashi	1969-72	1969
	*L. Lliboutry	1969-72	1969
	J. F. Nye	1969-72	1965
	*L. Gold	1970-73	1970
	*R. P. Goldthwait	1970-73	1970
	Miss C. A. M. King	1970-73	1969
	*H. Röthlisberger	1970-73	1970
	*W. Ambach	1971-74	1971
	*W. Dansgaard	1971-74	1970
	E. R. LaChapelle	1971-74	1971
	G. de Q. Robin	1971-74	1970
CO-OPTED	*V. M. Kotlyakov	1971-72	1971
	*W. S. B. Paterson	1971-72	1971
EDITORS appointed to serve on the Council:			
	R. J. Adie	1971-72	1964
	C. W. M. Swithinbank	1971-72	1970

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* No previous service on the Council

THE GLACIOLOGICAL SOCIETY

Cambridge CB2 1ER, England

DETAILS OF MEMBERSHIP

Membership is open to all who have scientific, practical or general interest in any aspect of snow and ice study. Members receive the Journal of Glaciology free. Forms for enrolment can be obtained from the Secretary. No proposer or seconder is required. Annual subscription rates 1972:

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I C E

Editor: Mrs. H. Richardson

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